REMARKS:

The undersigned attorney appreciates the telephonic interview granted by the Examiners Erdem and Flynn on September 3, 2003. During the interview, the Examiners pointed out that while the Office Action did not address specifically the claim limitation that the electric field applied to the elongated structure of the various claims is not less than about 1 MV/m across the structure, Pelrine et al. (US 2002/0008445 A1) disclose in paragraph 43 the application of an electric field of up to 440 MV/m to a polymer film or layer to cause the polymer to deflect. This point is taken into account and addressed in this amendment.

Claims 2-12, 16-21, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lieber et al. (US 2002/00130311 A1) in view of John et al. (US 2002/0074537 A1) further in view of U.S. Patent 6,423,583 to Avouris et al, further in view of U.S. Patent 5,705,824 to Lafrate et al., and further in view of Pelrine et al. The rejection is respectfully traversed.

In the rejection, the examiner relies on Lieber et al. for the disclosure of a doped elongated semiconductor having nanometer geometries. The Examiner admits that Lieber does not explicitly show the energy band structure or the application of electric field in such devices or the required electric field characteristics. The Examiner, however, is of the view that John et al. shows tunable photonic band gap materials, that Avouris et al. disclose electrically induced selective breakdown of nanotubes and Lafrate et al. show a field controlled current modulator based on tunable barrier strengths where the electric field is applied in the specific configuration. Furthermore, the Examiner is of the opinion that Pelrine et al. disclose an energy efficient electroactive polymer where the required electric field characteristics are disclosed.

The claims have been amended to clarify that the electric field applied to the elongated structure causes an electronic energy band structure of the structure to be modulated. This limitation is clearly supported by the description in the specification where the conduction band structure is described to be modulated by the application of the electric field. As amended, the claims are radically different from John et al. which

disclose a tunable photonic band gap rather than an electronic band gap. Thus the band gap that controlled in John et al. relates to the confinement and propagation of electromagnetic radiation whereas the electronic or conduction band gap in the rejected claims relates to the electrical conductivity of the elongated structure. Similarly, the application of AC field across a nanoscale structure in Lafrate et al. is to change the barrier potential strengths by matching a multiple of the AC frequency to the Bloch frequency, and not to modulate an electronic or conduction energy band structure. Avouris couple a voltage to the gate electrode and applies an electrical current through the nano tube to induce selective breakdown of the tube. Avouris et al., however, has failed to disclose the application of an electric field across the nanotube to modulate its electronic or conduction energy band.

None of the above references disclose the application of an electric field not less than about 1 MV/m for modulating the electronic or conduction energy band structure. While the coupling of the gate voltage may induce a small transverse electric field in an elongated structure such as a nanotube, such electric field is typically small and typically much smaller than the 1 MV/m required in the rejected claims. As taught by the specification in the present application, it is only by applying a sufficient electric field across the elongated structure that it is possible to noticeably modulate the electronic or conduction energy band structure, such as to narrow an electronic energy band gap (as disclosed in one of the embodiments).

While Pelrine discloses the application of an electric field to a polymer film of up to 440 MV/m, such electric field is applied to a polymer film or layer to deflect the polymer, and not to a nanoscale structure to modulate its electronic energy band structure.

To establish a *prima facie* case of obviousness, the Examiner must show that there was some teaching, motivation or incentive in the prior art to combine the cited references. *In re Geiger*, 2 USPQ2d 1277 (Fed. Cir. 1987). In particular, the cited references "must expressly or impliedly suggest the claimed combination or the Examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious..." *Ex parte Clapp*, 227 USPQ 972 (Bd. Pat. App. & Int. 1985).

As admitted by the Examiner, Lieber et al. does not show the application of electric field or the required electric field characteristics as applied to nanometer structures. While Lafrate et al. and Avouris et al. disclose the coupling of a gate voltage or AC electric field to nano scale structure, they relate to mechanisms for purposes radically different from Pelrine. Thus Avouris et al. couple a gate voltage and then pass electric current through a nano tube to induce selective breakdown. Lafrate et al. apply an AC field to control current modulators. Pelrine, on the other hand, applies the high electric field to a polymer to cause the polymer to deflect. In view of their very different purposes and goals, and the different types of structures the voltages or fields are applied to, there is therefore no reason or motivation for combining the magnitude of electric field disclosed by Pelrine et al. to the non-polymer nano scale structures of the other references.

From the above, it is believed that claims 2-12, 16-21, and 30 are patentable over the above-recited references.

Claims 13, 22 and 23 are rejected over the above-recited references and further in view of U.S. Patent 5,689,603 to Huth. The rejection is respectfully traversed.

Claims 13, 22 and 23 are believed to be allowable since they are either depend from allowable claims discussed above, or contain the same limitations as those discussed above for claims 2-12, 16-21, and 30, in view of the fact that Huth fails to remedy the deficiencies noted above of the primary references (Lieber, John, Avouris, Lafrate and Pelrine). These claims are further believed to be allowable on the ground of the further limitation added. While Huth discloses an optically interactive nanostructure where an optical absorption structure is shown, there is no showing in any of the references relied on by the Examiner that the shift in optical energy absorption wavelength characteristics is caused by the modulation of the electronic or conduction energy band structure of the elongated structure, as required in claims 13, 22 and 23. Furthermore, the Examiner has failed to show some teaching, motivation or incentive in the prior art to combine the cited references.

Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lieber, John, Avouris, Lafrate, Pelrine and further in view of U.S. Patent 6,153,318 to Rothberg. The rejection is respectfully traversed.

Since Rothberg also fails to disclose the limitation of the application of an electric field not less than MV/m, Rothberg fails to remedy the deficiencies of the other references pointed out above, so that Claim 24 is believed to be allowable for the same reasons as those explained above for Claims 2-12, 16-21, and 30. Furthermore, Claim 24 requires a source providing radiation to a portion of the elongated structure to cause a change in length of the structure. Rothberg fails to teach or suggest such a feature. Since it merely disclosed the application of an electric field rather than the application of radiation to the material to change its physical properties, the Examiner has therefore failed to supply a reference that teaches or suggests such a feature.

Claims 14, 15, 25-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lieber, John, Avouris, Lafrate, Pelrine and further in view of U.S. Patent 5,714,765 to Noetzel et al. The rejection is respectfully traversed.

The rejected claims contain the limitation that the electric field applied is not less than about 1 MV/m. Noetzel also fails to teach or suggest such feature and therefore fails to remedy the deficiencies noted above of the remaining references used in the rejection. The rejected claims are therefore believed to be allowable. The rejected claims are further believed to be allowable on the ground that the Examiner has failed to show a reason or motivation for the combination. Moreover, in the rejected claims, the quantum wells are developed as a result of the modulation in the electronic or conduction energy band structure caused by the application of an electric field. None of the references relied on by the Examiner, including Noetzel, teaches or suggests such a feature.

Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lieber, John, Avouris, Lafrate, Noetzel, Pelrine and further in view of U.S. Patent 6,333,516 to Katoh et al. The rejection is respectfully traversed.

Katoh also fails to teach or suggest the feature of the application of an electric field not less than about 1 MV/m and therefore fails to remedy the deficiencies noted above in the remaining references relied on in the rejection. Furthermore, the

Examiner has failed to show a reason or motivation for the combination as required by in re: *Geiger an ex parte Clapp supra.*

New claims 31-39 have been added to more adequately cover the invention. Carbon nanotubes are made of a homogeneous and crystalline material, so that there is adequate support for the claims added.

Claims 2-39 are presently pending in the application. Reconsideration of the rejections is respectfully requested and an early indication of the allowability of all the claims is earnestly solicited.

Please charge any additional fees required or credit any overpayment to our Deposit Account No. 502664.

Respectfully submitted,

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